COMMERCIAL-OFF-THE-SHELF INTEGRATION ISSUE PAPER

BACKGROUND

In 1991, the Defense Authorization Act established the Acquisition Law Advisory Counsel, whose mission was to simplify and codify defense acquisition law[1]. Council of experts from both the private and public sectors provided Congress with a 1,800 report, *Streamlining Defense Acquisition Law,* which addressed streamlining the acquisition statutes, simplifying the acquisition process, and facilitating access to and purchase of commercial technologies, products, and services at competitive market prices[1]. The latter issue brought insight to government agencies investigating the benefits of utilizing commercial products to better service the defense community. In 1994, Dr. Paul Kaminski, Chairperson of the Defense Science Board (DSB), approved a DSB task force recommendation which stated that DoD should revamp its software procurement practices and start adopting and implementing commercial practices. Through the establishment of the council and the recommendation by the DSB task force, the government decided to further investigate the integration of Commercial Off-the-Shelf (COTS) in both hardware and software. COTS software integration efforts have been prevalent in the Automated Information System/Management Information System (AIS/MIS) environment, as opposed to the Mission Critical Computer Resource (MCCR) environment. Since COTS software integration is relatively new to MCCR systems, this paper addresses AIS/MIS systems' COTS software integration experiences.

IMPACTS OF COTS INTEGRATION

While the integration of COTS software has impacted the DoD community both positively and negatively, nonetheless, all of the experiences have been beneficial in furthering DoD's understanding of the ramifications of purchasing COTS software for future systems. The following is a list of advantages and disadvantages cited by programs who have experience with COTS software integration:

Pros
1. Decreased Development Effort

    With the use of COTS software, there are decreases in the effort to develop and test the code, as well as a corresponding decrease in risk. COTS software increases productivity by decreasing the lines of code to be developed and improves quality by the use of already tested and proven code. A well-used COTS application is refined through updates (or versions) and corrected for latent defects - making it more reliable than newly developed and untried code [1]. The extra time to test the software is not required for COTS software because the COTS code has already been tested prior to packaging.

2. Faster Procurement Process

    The COTS procurement process is less formal and less competitive than the normal DoD procurement process. With the purchase of COTS software, many reviews are not mandatory as they are for newly developed software. The less

formal review process causes quicker release to the user. "The advantages of buying commercial software, that meet DoD's requirements, are higher quality, lower cost, faster acquisition time and more flexible maintenance."[1]

3. Increased Reusability

When systems are built simply as components for other systems, then COTS software is the best choice. With the appropriate architecture, COTS software can be shared across several projects[2]. Sharing the COTS software leads to higher reuse of the software. The reuse of the COTS software provides two more advantages: increased productivity and reliability.

Cons

1. Increased Configuration Control Problems

According to Ref [1], configuration control is a problem because, "Although [purchasing COTS software is] cheaper than developing it yourself, be aware it is often difficult to integrate all the COTS applications (especially for weapons systems) needed to provide the required functionality. Even if your integration is successful, (for example, with 26% COTS combined with 74% developmental software) you can encounter configuration control problems."[1] Also, the vendor determines when an upgrade will occur and when it will be released to the user[4]. Military planners are starting to realize that the Pentagon has little ability to impose reliability and maintainability standards on COTS suppliers. "Systems buyers are finding that information on the performance of COTS gear is often withheld by commercial vendors who see no need to bend to the demands of their military customers."[3] Unless the government has signed an agreement with the vendor to maintain, upgrade and supply services whenever needed, the government is at a loss when services need to be performed on the COTS software.

2. Obsolete COTS Software

DoD's procurement cycle for major software intensive programs is usually 10-plus years from inception to IOC. In the software life cycle world, a product is developed in 12-18 months and becomes obsolete in 36-48 months. Hence, it is possible that for a major weapon system, the COTS software will be obsolete by the time it is fielded[1].

3. Inability to meet Requirements

The worst purchase DoD can make is the purchase of COTS software that doesn't meet the system's requirements. Barry Boehm stated in Ref [2] that, in the old process requirements drove the capabilities, but in the new process, capabilities will drive the requirements. He also said, "It is not a requirement if you can't afford it." Purchasing COTS software that doesn't meet requirements leads to a bigger problem, modification of source code. The data rights to the source code are not guaranteed with the purchase of COTS software, therefore making it difficult to modify the code. Modification decreased leads to several problems: incompatibility with new releases; decreased reliability of software decreases;

wasted time to patch old technology while the new technology passes it by; inconsistency with the vendor's development schedule; and maintenance problems. "There is a basic reason why we do not want to engage in the modification of COTS. If [the customer changes] even a small portion of a COTS product, then when the next version comes out [the customer's] software will no longer be compatible or upgradeable to it."[1] NASA's Jet Propulsion Laboratory (JPL) program manager stated that modified COTS can cause the biggest problems. "People say they've got a product that meets their requirements, but then get into modifying the COTS software packages, and the problem they now have is accommodating new releases."[3]

EFFORT & MAN-YEAR ESTIMATING RECOMMENDATION

It is apparent, based on the impacts listed above, that the effort expended for newly developed software is vastly different from integrating unmodified COTS software. Unfortunately, based on the literature search conducted by the NCCA software team, none of the reports provided any quantitative approaches for adjusting NCCA's effort estimate (which reflects MCCR systems) to reflect the integration of COTS software effort. Again, the above lessons learned from integrating COTS software have been experienced on AIS/MIS programs. Therefore, since COTS can be viewed as reused/modified code, NCCA recommends the following procedures be followed when an analyst is estimating the effort for COTS software integration:

1. If a program is employing COTS software and the COTS code will remain **unmodified**, the effort to convert COTS code to equivalent new lines of code is equivalent to that of verbatim code. NCCA recommends that the analyst use the CSCI level effort ESLOC factor of 3 percent (i.e., Equivalent New COTS Code = 0.03 * Total COTS SLOC). Refer to the NCCA Software Compendium for more detail on the equivalent code conversion for verbatim code.

2. If the program is employing COTS software and the COTS code will be **modified**, the effort to convert the COTS code to equivalent new lines of code is equivalent to that of modified code. NCCA recommends that the analyst use the program level effort ESLOC factor of 30 percent (i.e., Equivalent New COTS code = 0.30 * Total COTS SLOC). Refer to the NCCA Software Compendium for more detail on the equivalent code conversion for modified code.

Ultimately, in order to reap the true benefits from purchasing COTS software, DoD needs to be mindful of the following:

- COTS software should drive the requirements, which in turn will result in no modifications. When COTS software, that meets the user's needs, is available, DoD should use it. If DoD's initial intent is to modify the COTS software, DoD should opt to develop the software vice modifying a commercially available package.

- Make certain that a Vendor-DoD agreement exists for service and maintenance beyond the initial purchase. The Air Force recommends the signing of a cost-plus-fixed-fee or firm-

fixed price-incentive-fee contract to ensure the vendor will propose the best long-term solution[1].

REFERENCES

[1] Department of the Air Force, <u>Guidelines for Successful Acquisition and Management of Software Intensive Systems: Weapon Systems, Command and Control Systems, Management Information Systems, Volume 1</u>, February 1995, pp. 5-87 -10-10

[2] Vigder, Mark R., W. Morven Gentleman, John Dean, COTS Software Integration: State of the Art, January 1996, pp. 1-25.

[3] Dizard III, Wilson, <u>Military & Aerospace Electronics</u>, COTS skeptics cite risks of commercial software, June 1996, pp. 1-32.

[4] Jones, Capers, Build, buy, or outsource?, <u>IEEE Software</u>, December 1994, p. 77.

[5] Office of the Under Secretary of Defense for Acquisition & Technology, <u>Acquiring Defense Software Commercially</u>, June 1994, pp. 1-29.